A Critical Decision-Making Training Framework for Leadership Development

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ABSTRACT

The counterinsurgency environments in Iraq and Afghanistan pose special challenges that are difficult, time consuming, and expensive to emulate using conventional training approaches. Deployed American Soldiers, operating amid civilian populations, continuously encounter unfamiliar complex dilemmas that demand decision-making in the wake of ambiguity. The requirement for decision-making is not reserved for senior leaders with deep experience. Rather, it extends to even the newest Private and Second Lieutenant. This paper describes the development of an immersive training framework for the US Army Center for Army Leadership that subjects the learner to complex critical decision-oriented scenarios patterned after incidents gathered from the field. Scenarios are designed to pose 'leadership dilemmas' for the learner which generate immediate and long-term outcomes based on those decisions. Over time successive decisions generate variability in the simulation, which pose new challenges to the learner, namely the need to understand that decisions have implications beyond the immediate impact. This approach is designed to purposefully engage the learner in additional 'what-if' scenarios, while promoting personal reflection and dialogue with others towards alternate strategies within the decision-making process.

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INTRODUCTION

Decision making in the Army is perhaps more important now than it has ever been; certainly more Soldiers need to be adept at making decisions than ever before. Over the past decade, responsibility for making decisions has been pushed down to lower ranks and these decisions can have far-reaching effects. Embedded journalists and a 24-hour news cycle mean that decisions made in remote combat locations can be broadcast around the world in a matter of hours. Increasingly leaders must make smart, well-informed decisions with incomplete or ambiguous information, while quickly analyzing the near-term and long-term consequences of those decisions. Thus, in selecting a topic appropriate for training via simulation, the Center for Army Leadership (CAL) determined that decision-making was of critical importance. Specifically, the following aspects of decision-making were viewed as particularly important for today's Army leaders:

- Decision dilemmas, in the form of equally appealing or equally unappealing choices, such that there is no clear "right" or "wrong" choice
- Making decisions with incomplete or ambiguous information
- Predicting and experiencing second-order and third-order consequences of decisions.

Decision-Making Theories and Frameworks

Decision making theory has a long and varied history. In the 1950's, Ward Edward initiated what is now thought of as the first scientific inquiry into how people make decisions (Edwards, 1954). Adhering to a classical or rational approach to decision-making Ward and his protégés viewed decision-making as fundamentally a hypothesis testing process (Edwards & Tversky, 1967). In this process, gathering information and assessing probability and its associated risk figured prominently. Human cognitive limitations and its propensity for error did not figure prominently in classical decision-making theory. Rather, a person was assumed to have access to all knowledge and the ability to accurately assess its probability and risk.

In the mid 1980's, advances in human cognition theory together with deserved criticism of classical decision-making theory led to the formation of an alternative paradigm – that of naturalistic decision-making (Flin, Salas, Strub & Martin, 1997). Rather than being known, the environment for naturalistic decision-making is ambiguous and characterized by missing or incomplete information. And human decision makers are assumed to have cognitive limitations, be prone to error, and possess limits in their ability to think rationally. Goals or choices, rather than being fixed and amenable to quantitative probability and risk assessments, are ill-defined and subject to change in naturalistic decision-making (Orasanu & Connelly (1993). Naturalistic decision-making also places considerable emphasis on time, or the lack of it, before one must make a decision. Consequently, naturalistic decision-making postulates that a person's experience at making decisions and their powers of perception are what drives or influences the decision they ultimately make.

A popular application of naturalistic decision-making is the study of intuition or 'gut' instinct. Proponents of this approach have devised rules for when and when not to 'go with one's gut.' And they provide ways of developing or improving gut instinct toward overall better decision-making and performance (Klein, 2003). The power of perception is also a strong influence in the "lens model" theoretical framework for decision-making (Brunswik, 1956). According to this framework, people possess a set of 'lenses' through which cues from their environment are filtered. Direct observation of environmental phenomena is not possible; only cues of it are accessible by human senses and perception. Consequently a person's lens influences the accuracy of the information they process for decision making. This framework for understanding decision-making is a central tenet of social judgment theory (SJT). According to SJT people accept or reject communications or messages (e.g. cues) to them based on how it matches with their currently held views (e.g. lens) (Arkes & Hammond, 1986). Such views are socially constructed or developed through life experiences. Acceptance or rejection results in a decision based on how the individual will respond to the message or communication.

Beyond socially constructed lenses, decision-making is also influenced by the actual construction of the brain and its associated cognitive processes. This understanding has contributed to the development of various descriptive theories of decision making. Such theories offer a series of steps detailing how decisions are made along with techniques for countering certain biases inherent in the process. The emergence of heuristics or 'rules of thumb' for making decisions has evolved out of the study of descriptive theories of decision-making (Shaban, 2005). "Anchor and adjust," for example, explains how people depend on previous experiences (the anchor) to make decisions (Fiske & Taylor, 1984). "Adjust" is the technique a person needs to employ to counter rote duplication of the same decision. The adjust step requires that one compare and contrast the previous experience to the current one, making changes to the decision as needed.

Applying the Decision-Making Framework to the Simulation

Prior to and during development of the decision-making framework, we referred to several of the theoretical frameworks previously discussed. From among them, the idea of setting the simulation in a naturalistic decision-making environment emerged. The ambiguous, less than perfect information and limitations of human perception, match well with the contemporary operating environment in which US Army leaders routinely face. From among the various frameworks that take a naturalistic approach, two in particular were important to the development of the simulation. First, Snowden and Boone's (2007) Cynefin Framework (**See Figure 1**) for decision-making provided a useful way to think about the context for the simulation. The framework identifies five contexts, defined by the predominant cause and effect relationship found in each, in which a leader may find him- or herself: simple, complicated, complex, chaotic, and in-disorder. In keeping with the important aspects of decision-making we identified, our focus was on the ordered complicated and unordered complex domains. Complex contexts are characterized by the lack of a clearly right answer, unpredictability, and flux. Snowden and Boone argue that in such a context, a leader should first probe or investigate, then assess the facts, and finally respond. Such contexts often require creative or innovative decisions, which may be accompanied by a risk of failure. Consequently, inexperienced leaders or leaders who are not comfortable with the uncertainty of the situation may fall back to a more controlling style of decision making.

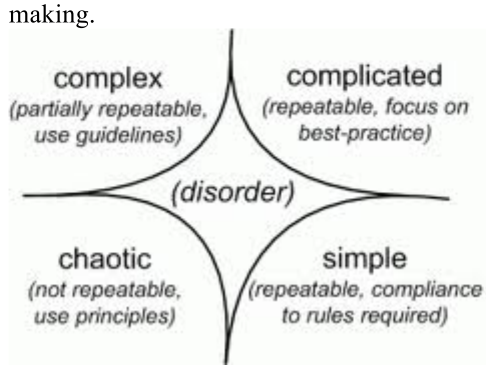

Figure 1: Cynefin Framework

Theoretical Approach:

The Decision-Making Framework (Drift Framework) was designed to consider the complex nature of decisions in often ambiguous environments. Dilemmas are represented as simple and ordered and as the simulation progresses choices become unordered and complex. Put plainly, as more happens in the simulation, situations turn from ordered decisions to unordered. The learner must gather data from multiple sources and become aware of patterns in the environment in order to evaluate a best course of action. Thereby the simulation progresses towards more ambiguity and the learner must examine problems beyond single variable possibilities.

The second theoretical model that provided structure to the decisions featured in the simulation was Quinn and Rohrbaugh's (1981) competing values framework. The primary tenet of the model is that organizational effectiveness is dependent on meeting numerous performance criteria that are organized by four value sets. At its core, this model is based on tensions – tensions between values and tensions between choices. In applying the competing values framework, we attempted to create tension between decision options. One source of tension was that for many of the scenarios, the decision choices were equally attractive or equally unattractive. There were numerous trade-offs among the choices, so that no single option was clearly advantageous. Another source of tension was between immediate outcomes and long-term outcomes of the decisions. For example, for a particular choice, the immediate outcomes may be very positive but the long-term outcomes are disastrous for one or more parties. Alternatively, another choice may lead to negative immediate outcomes, but the long-term outcomes are beneficial. An added advantage to using the competing values framework was that it contributed to the realism of the decisions. Often, real-life decisions are not clear-cut and trade-offs must be weighed.

Technical Approach

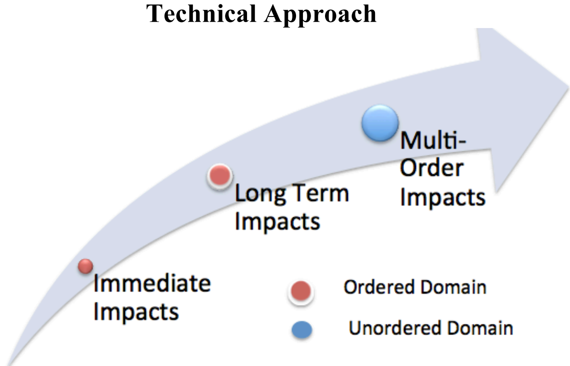

Figure 2: Technical Framework

Our initial objective was to create a framework for presenting competing information and determine a best course of action. It was decided that, in order to constrain complexity, the framework would be designed to present decision dilemmas as discrete points in the simulation rather than continuous actions taken to shape the simulated environment. These discrete decision points would be multiple choice dialogue interactions where virtual avatars (one or more) would provide context to the decision. And whereas there are many and varied theories and frameworks about how a leader ought to make decisions, the simulation does not prescribe one best approach. Rather it puts the leader in a complex, ambiguous and complicated cause and effect environment in which conditions of decision-making permit the player to implement any number of decision-making sets, processes or techniques (information gathering, social judgment, weighing of costs and benefits, relying on 'gut' or intuition, applying heuristics, etc.). Supporting web-based instruction on decision-making provides learners with a repertoire of techniques to practice within the simulation. And, simulation after action sessions cause the leader to reflect on and examine the methods of decision-making they employed and how successful (or not) they turned out to be.

Ordered Domain Impacts: The first tier of the framework was to develop complicated ordered domain relationships so that learners could consider fundamental impacts of choices, both immediate and long-term. In concert with the Cynefin complicated model, the first order impacts of decisions suggest to the learner that the cause and effect relationship requires some analysis and investigation but no more than subject matter knowledge and awareness of general situational parameters.

Decision impacts are defined as $D = \{T(R(n))..\}$ where decision **D** results in multiple outcomes **R(n)** occurring either immediately or over time **T**. Note that in the ordered domain, long-term impacts are still non-emergent in that there is a direct relationship between situation and impact, although the impact may take time to appear to the learner. For example, three months after a rusted water main is not replaced or repaired, water will eventually seep through.

Modeling in the Unordered Domain

The unordered domain is the area in which the relationship between cause and effect can only be perceived in retrospect, but not in advance, the approach is to *Probe - Sense - Respond*. In order to model the complex domain, impacts must be fettered out through sense making, probing, and recognizing patterns in the web of interactions. Our attempt to model the complex domain was to generate patterns that occur in the simulation caused by the combination of several actions and conditions. As an example, we can begin with a problem *When Do Rebels Attack?* The scenario *Rebels Attack* is a result of several conditions that must occur:

- A maximum threshold of rebels must be available to fight
- A hole in defenses
- The defending security force must be low
- Attacks occur at night fall

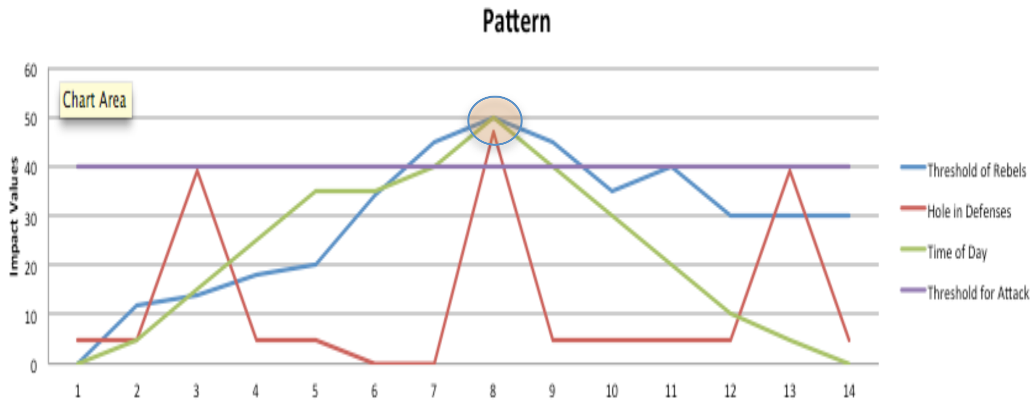

Figure 3: When Rebels Attack

Within the sphere in **Figure 3**, we present multiple values for each of the conditions, and if all conditions satisfy or exceed the threshold for attack (purple), the event is triggered.

Mission at Mubasi: An Implementation of the Drift Framework

An implementation of the Drift Framework was created for the US Center for Army Leadership's Muti-Source Assessment and Feedback (MSAF) program called Mission at Mubasi. The context of the simulation is to enable senior NCOs and junior officers to enhance their decision-making skills by immersing them in an engaging interactive game based training environment. Mission at Mubasi is based on a fictitious North African country that is in need of governance and infrastructure development. Within the game the learner plays a leader new to the African country situation (i.e. taking over from a previous leader) and the environment is negative for several reasons including lack of support for the Army governance, lack of ample food and water, and minimal security. There are also multiple parties with differing, sometimes conflicting, priorities and interests that the leader must address. In the course of the simulation, the leader goes through a series of scenarios in which he or she is provided with incomplete, ambiguous information from multiple sources, and then must select an option from various courses of action, none of which were designed to be ideal responses over the others.

Game Variables: Within the game the learner's objective is to maintain four important aspects of the governance process: relationship and positive affect of the villagers, well being of his soldiers, security in the environment, and transitioning governing capacity to the local tribes. Each of these values will be modified during the simulation by decisions and actions taken by the learner.

Conditions will arise either through proactive decisions by the user, or injects (*events*) that will dynamically modify the conditions within the simulation. The Primary Variable is composed of several Micro Variables (MVs). These MVs are assigned a weight of importance by the developer, and are modified directly by the simulation in order to determine the value of the Primary Variable.

Resources: Within the simulation the learner is responsible for optimally using and maintaining several resources towards the success of the mission. These resources include food, money, political capital, medical supplies.

Win Game Scenario: If the user is properly engaged in the simulation and is generating positive results, the Primary Variables (villager relationship, soldier well-being, etc.) should all be increasing towards a *success threshold*. This threshold value for each of these variables will be built into the simulation where once all the variables have surpassed this value, the simulation is complete. The communicated reward for the leader is seeing all of the positive results in the scenario. Conversely, if all four variables fall below the minimum threshold, and remain there for a designated period of time, the leader is advised that the situation has deteriorated to the point where the scenario is unwinnable. They may restart the game and try again.

Developing Scenarios

Our approach to developing the scenarios was iterative and systematic, while leaving room for creativity and emotional verve. In all, 11 scenarios were developed. Initially, we developed a single, prototypical scenario to practice applying the theoretical principles discussed previously and to refine our process. As a result of developing this ideal scenario, we arrived at the following process:

1. Create brief descriptions of all scenarios
2. Detail each scenario in turn
3. Review by an Army subject matter expert (SME) and revisions
4. Final review and revisions
5. Detailing of long-term outcomes

Each of these steps is described in detail below.

Create Brief Descriptions of All Scenarios
Our first step was to write brief descriptions, about a paragraph in length, for each scenario. This allowed us to create an overarching storyline across all of the scenarios, bringing cohesion to the scenarios. These descriptions also served as a map for developing each of the scenarios, such that when developing an earlier scenario we could create decision options that would set up later scenarios.

Detail Each Scenario in Turn
Following the creation of brief descriptions of all of the scenarios, each scenario was developed in detail sequentially. These details included:

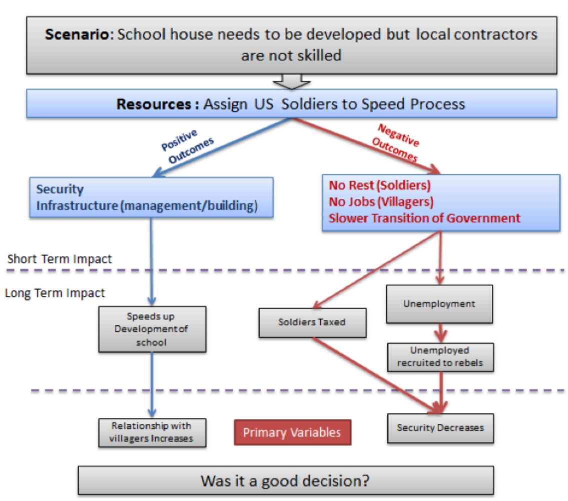

Figure 4: Example Decision Tree

- Identifying the characters appearing in the scenario, including their names, appearances, backgrounds, and roles.
- Selecting the physical setting of the scenario.
- Identifying the situation and the decision to be made.
- Competing values represented in the decision.
- Identifying resources gained and expended by each decision option.
- Developing dialogue between the leader and other parties.
- Defining immediate outcomes.

In addition, the long-term outcomes were described at a high level.

Review by an Army SME and Revisions
At this point in the process, a scenario was substantially complete and ready for reviews. The first review was by an Army SME who was very recently retired from the Army. This SME had recent deployment experience relative to the simulation environment and could ensure that the details were realistic. In particular, the SME provided input to add authenticity to the dialogue.

Final Review and Revisions
Following revisions based on the Army SME's feedback, the project manager reviewed each scenario and provided feedback. Upon making the recommended changes, the scenario was handed over to the technology team.

Detailing of Long-Term Outcomes and Competing Issues
The long-term outcomes were mini-scenarios, including most of the same details needed for the scenarios, such as characters, a description of the physical setting, and dialogue. The process produces a multiple page document which builds a hierarchy diagram of competing possibilities for a decision. In **Figure 4**, a single decision for the scenario "School House Construction" outlines the possible outcomes of assigning US soldiers to take over construction rather than have locals do the work. Note in the example, short-term villagers are out of work and soldiers are overtaxed, but the completion of the school in a timely manner creates a strong relationship between villagers and US leadership.

Virtual Environment and Gameplay

The Mission at Mubasi Decision-Making Simulation was developed using a 3D immersive web deployable gaming engine accredited for use on the Army Knowledge Online Portal. The virtual environment contained several indoor and outdoor areas (refugee camp, downtown, water treatment plant, FOB, farm, school house, and new construction areas) and over 400 virtual avatars that provided interaction and feedback to the learner while immersed in the gaming environment. As the learner progressed through the simulation, visual and audio cues were provided to help guide the progress on each of the primary variables. For instance if villager well-being was low, villagers would sit idle in the streets and less activity would be taking place in the market.

Figure 5: Competing Decisions

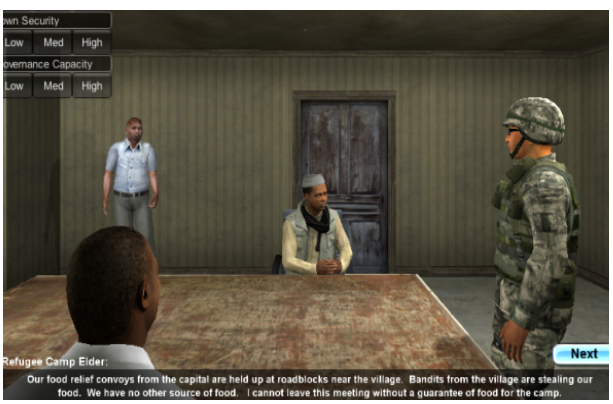

Figure 6: Game environment

Beta Test

A beta test of the Mission at Mubasi Decision-Making Simulation was held at an Army classroom with 16 standard army desktop computers. Participants were in the range of senior non commissioned officers, and junior officers. Participants were given introductory information on how to use the simulation, and were then asked to play through eleven scenarios, complete an after action review and respond to the questions below:

1. *Were the decision dilemmas significantly challenging?*
2. *Was it clear that decisions you made were tied to outcomes (multi-order effects) in the virtual world?*
3. *What aspects of the simulation did you find engaging or stood out as well done?*
4. *What, if anything, would you change about the simulation?*

Results

Our first objective was to determine if there were significant and realistic decision dilemmas in the simulation based on experiences of the participants. Learners felt that the dilemmas presented were generally representative of their deployment experiences, and some commented about how a certain dilemma was indicative of something that they had experienced on one of their tours.

In terms of responding to the decision dilemmas, several participants felt that without enough information, especially in the early phases of the simulation, it was difficult to evaluate a best course of action. But the consensus was that it is unlikely a leader would always have all relevant information available to them in a real-life situation, and sometimes "you had to do the best you could".

Our second objective was to make sure that outcomes in the environment (multi-order effects) were clearly tied to decisions or groups of decisions. This was a difficult challenge as information in the simulation was coming from multiple sources; it was therefore decided that directing the learner towards specific cues would be very important in making sure they understood the relationship between cause and effect.

Several participants were looking for additional feedback and interaction from the multitude of avatars that populated the environment and there was an interest in 'undoing' a decision after it had been made. It was explained to the participants that as in life, one cannot undo a decision, but subsequent decisions can counter balance earlier choices. Some felt decisions were geared toward senior leadership and a future version of the simulation needed to be directed to the squad level, although most of the participants felt the decisions dilemmas were very relevant to both NCOs and officers.

Overall, learners found the simulation engaging and straightforward to navigate. It was decided early in the process that an immersive game environment with realistic avatars, story arc, buildings, and visual effects would add engagement to the simulation without detracting from the learning objectives. Of the 11 scenarios, the ones that had more emotional visual and audio cues (i.e. an attack on the Forward Operating Base), the participants felt most connected to the outcomes.

A percentage of the non-gaming participants initially had some difficulty learning to navigate in the 3D environment, although we specifically wanted to make sure that navigation was not critical to gameplay.

The After Action Review (AAR) presented at the end of the simulation was regarded as very helpful in tying together the immediate and long-term impacts of the decisions. There was a discussion at the second beta test to present an AAR review for each leadership dilemma directly after the scenario had completed rather than waiting for the entire simulation to unfold.

Conclusion

A great deal of work within the Drift Framework was designed to challenge the user to recognize cues in the environment beyond traditional analysis of cause and effect. The emergent patterns (unordered domain) were designed to suggest to the learner that multiple decisions that were weighted towards any one of the variables could jeopardize the end result of the game. For example, if the learner were to make constant decisions towards his soldier's well being while not considering villagers' well-being or security, eventually this would cause events in the simulation that would decrease the overall success of the mission. Data collected from our users showed that emergent pattern recognition was most helpful when cues were ample, relevant, and consistent in the simulation. If cues were occurring in simulation which did not appear to coincide with decisions, it was more difficult for the learner to recognize the decision impact. The instructional designers used user interface cues to help clarify multi-order effects. For example, animating energy bars on the user interface helped to focus the attention of the learner on global changes in the environment, rather than direct impacts based on immediate decisions.

Potential work in the development of the Drift Framework will center on removing discrete decision points and will present a more dynamic procedural based approach to complex decision making. This undertaking will follow a rigorous design and testing phase of several game mechanics that will be evaluated for ease of use by the instructional designers.

ACKNOWLEDGEMENTS

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